Title: Amendment to the Environmental Permitting (England and Wales) Regulations 2010 - new schedule for Materials Recovery Facilities (MRFs) **IA No:** DEFRA 1481 **Lead department or agency:** Defra **Other departments or agencies:** Welsh Government	**Impact Assessment (IA)** **Date:** 26/10/2012 **Stage:** Development/Options **Source of intervention:** Domestic **Type of measure:** Secondary legislation **Contact for enquiries:** Simon Dawes, Waste Policy, Area 6D, Ergon House, SW1P 2AL simon.dawes@defra.gsi.gov.uk 020 7238 5494

Summary: Intervention and Options

RPC Opinion: GREEN

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANCB on 2009 prices)	**In scope of One-In, One-Out?**	**Measure qualifies as**
-£8.2m	-£8.2m	£0.9m	No	NA

What is the problem under consideration? Why is government intervention necessary?

Our approach to collecting recyclate needs to generate material of sufficient quality to meet the needs of reprocessers (a requirement of the EU Waste Framework Directive) and comply with international rules on waste shipments. Market signals regarding quality are not working in the way they should, partly because MRFs are not measuring the quality of their output material or making this information transparent. This is causing inefficiencies in the market and MRFs delivering recyclate of sub-standard quality in some cases. Government intervention is needed to address the market failure of imperfect information, and demonstrate to the Commission where co-mingling is capable of supporting the WFD objective of high quality recycling.

What are the policy objectives and the intended effects?

We want all MRFs to monitor the quality of their output material streams in a robust manner and to make this information transparent. This will help stimulate the market conditions needed to improve recyclate quality and so supports both the objective in the WFD to promote high quality recycling and compliance with the Waste Shipments Regulation. Delivering high quality recyclate is important because it can help support the economy and growth of the recycling industry by maximising the economic value of the material collected. By minimising the amount of recyclate collected that ends up in landfill it also helps increase public confidence and participation in recycling and maximise the environmental benefits of recycling.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

The impact assessment considers two options:
Option 0 - do nothing, so maintaining the status quo, not introducing the proposed changes
Option 1 - introduce a mandatory requirement on MRFs, via an amendment to the Environmental Permitting Regulations, to monitor the quality of their input and output material streams.
Option 1 is the preferred option.

A voluntary approach to encouraging MRFs to measure quality has already been attempted but it failed to attract significant uptake as many MRF operators felt voluntary compliance would leave them at a competitive disadvantage. Industry needs confidence of a level playing field before they are willing to invest in monitoring systems or make information on the quality if their outputs available to the market.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 04/2017

Does implementation go beyond minimum EU requirements?			No		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro** No	**< 20** No	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:**	**Non-traded:**	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible SELECT SIGNATORY: ..... Date: .....

Summary: Analysis & Evidence

Policy Option 1

Description:

FULL ECONOMIC ASSESSMENT

Price Base Year 2012	PV Base Year 2012	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low:	**High:**	**Best Estimate:** -8.2

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0.5			**6.1**
High	0.9	1		**10.3**
Best Estimate	0.8		0.8	**8.2**

Description and scale of key monetised costs by 'main affected groups'

Costs to MRF businesses of purchasing equipment for sampling, installing IT systems and initial pre-entry audit of £0.8m. Annual costs to MRFs of separating and sorting samples, testing and recording data of average £0.85m per year from 2014.

Other key non-monetised costs by 'main affected groups'

Additional costs to EA of collating and storing information.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				

Description and scale of key monetised benefits by 'main affected groups'

Indirect benefits of better flow and transparency of information are described below and are expected to benefit businessesand local authoritites in the reycling supply chain. There are also likely to be indirect benefits to society of reduced greenhouse gas emissions. See Tables 12 and 13 on pages 15 and 16.

Other key non-monetised benefits by 'main affected groups'

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5%

The costs of regulation are based on estimates provided by EA and WRAP. It is assumed that to capture the wider benefits, some parts of the chain are incetivised to increase returns and will respond to more transparency of information on quality. The wider benefits are based on material price ranges of 25% around the prevailing prices. Significantly lower material costs will reduce the potential wider benefits of this policy.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 0.9	**Benefits:**	**Net:** 0.9	No	NA

Evidence Base (for summary sheets)

1. Introduction

A Materials Recovery Facility (MRF) is a specialised plant that receives mixed dry recyclable materials (e.g. paper, plastics, metals, glass) which it then sorts, via a combination of manual and automated processes, into separate material streams and prepares for marketing to reprocessors.

MRFs require an environmental permit under the Environmental Permitting Regulations. We want to use the environmental permitting system to require MRFs to monitor the quality of the material they output. We need quality to be measured in order to demonstrate co-mingling is capable of supporting the EU Waste Framework Directive (WFD) objective of high quality recycling. It is also expected that this measure will result in material being more readily recycled. We propose to achieve this by requiring facilities to test the composition of samples of the material they put into the sorting process, the residues, and the useable output (or 'recyclate'). We propose to limit this to facilities which sort mixed dry recyclate from household and commercial co-mingled collections and those handling more than 1000 tonnes per annum. The intention is that the test results would be supplied, via the Environment Agency, to local authorities and reprocessors to help them identify which MRF best meets their requirements on quality.

The regulatory proposal is largely based upon a Code of Practice developed by the waste management industry.

2. Problem under consideration

Market signals regarding quality are not working in the way they should, partly because MRFs are not measuring the quality of their output material or making this information transparent to the market. This is causing inefficiencies in the market and MRFs delivering recyclate of sub-standard quality in some cases. Government intervention is needed to address the market failure of imperfect information, and demonstrate to the European Commission where co-mingling is capable of supporting the WFD objective of high quality recycling.

In general, there are more environmental benefits in turning recyclate back into a product of similar quality to what it was originally as producing higher quality raw materials usually causes more environmental impact. This is often referred to as 'closed loop' recycling, and examples include:

- The use of recovered glass in remelt applications to create new glass products (rather than for aggregate in construction);
- The separation of recovered plastic into individual polymers to produce, for example, new food and drinks containers (rather than the use of mixed polymers for low grade construction products);
- The use of recovered paper for the production of new paper products (rather than other uses such as animal bedding, insulation etc.).

For a given amount and cost of recovered material, the aim must be to maximize the benefit of using the recovered material, compared to having to extract and treat virgin material. The higher the financial and environmental cost of using virgin material, the greater the benefit of recycling. In most cases this would occur when the recovered material is being used for high quality applications[1]. Indeed, the revised Waste Framework Directive (rWFD) requires us to promote high quality recycling as a way of maximizing the environmental benefits of recycling.

[1] This is not to say that there isn't a place for 'down-cycling', and it is recognised there will be limitations, such as cost, market demand/capacity and food contact issues, to the amount of material that can be subject to closed-loop recycling.

The rWFD also recognises that high quality recycling operations, which turn waste back into the same product as it came from, need good quality material as feedstock. Specifically, Article 11 states:

> *Member States shall take measures to promote high quality recycling and, to this end, shall set up separate collections of waste where technically, environmentally and economically practicable and appropriate* ***to meet the necessary quality standards for the relevant recycling sectors****.*

When we talk about the quality of recyclates we are generally referring to its grade (e.g. polymer type) and composition (i.e. how much of the consignment is made up of **target material** compared to the amount of **non-target material** and other **non-recyclable material**).

Only target material is likely to be recycled, so a high proportion of non-target and non-recyclable material will reduce the quantity of recycling, or yield. A high proportion of non-target and non-recyclable material can also make it more difficult for reprocessors to achieve 'high-quality' recycling and if the recyclate is of poor quality it is more likely to end up being down-cycled or, in more extreme cases, sent to other recovery or landfill.

The Waste Review and the Responsibility Deal with the Waste and Resource Management Sector both recognised quality of recyclates as one of the principal challenges that need to be addressed if we are to realise our longer-term vision of a green, zero waste economy. The Waste Review states that we want to:

> *Ensure our approach to extracting recyclables, such as paper and plastic, from our waste generates material of sufficiently high quality to meet the needs of reprocessors here and abroad and to comply with the international rules on waste shipments. (para 32 of the Waste Review)*

We believe that the market should deliver recyclates of sufficient quality to meet the needs of reprocessors. However, although buyers and sellers are agreeing prices in the market for recyclates, there are strong indications that market signals regarding quality appear not to be working in the way they should. This is resulting in inefficiencies in both economic and environmental terms, and delivering material of sub-standard quality in some cases.

Whilst MRFs are capable of meeting the quality specifications of reprocessors, there is evidence that this is not always the case. Table 1 summarises the results of WRAP research[2] which identified a broad range in quality with some good quality outputs but also some with high levels of non-target and non-recyclable material. A WRAP survey[3] indicated that reprocessors saw the need for there to be improvements in the quality of material from UK MRFs:

- Over 60% said only "some" or "hardly any" output from MRFs met their quality specification
- Over 75% said the quality of outputs from MRFs was worse than material from other sources.

[2] MRF Quality Assessment Study, 2009

[3] MRF Output Material Quality Thresholds, 2009

Table 1: Percentage of MRF non-target and non-recyclable material

Target material	Min %	Mean %	Max %
Aluminium	0.0	2.5	8.1
Steel	0.4	6.2	23.8
News and PAM	1.9	9.8	22.0
Mixed Paper	2.1	15.8	36.7
Card	1.9	12.0	57.4
Mixed Plastic	0.6	18.2	43.5
Mixed Plastic Bottles	0.5	12.2	23.0
HDPE Coloured Plastic Bottles	3.3	8.7	12.2
HDPE Natural Plastic Bottles	0.8	4.5	14.6
PET Clear	0.5	7.5	20.1
PET Coloured	3.0	8.1	13.2

The causes of this problem are complex; one contributing factor is that a significant proportion of MRFs do not currently measure the quality of their input and output material streams on a routine, robust or consistent basis, or make this information transparent to customers. This has a number of negative impacts, including:

- If a MRF doesn't measure quality, then it cannot manage quality; and
- Customers of MRFs (e.g. local authorities, reprocessors) experience difficulty differentiating between high and poor quality MRFs, therefore market signals for quality outputs are not as strong as they could be and there is little competition between MRFs on grounds of quality.

3. Policy objective

To help stimulate the market conditions necessary to achieve an improvement in recyclate quality, and support the objective in the rWFD to promote high quality recycling, by establishing a consistent, industry-wide method for sampling and compositionally testing the quality of input and output material streams from MRFs in a robust manner.

Delivering high quality recyclate is important because:

- It can help **support growth and the green economy** by maximising the economic value of the waste material collected. Higher income levels from the sale of quality recyclates can return value to local authorities, householders and businesses. Conversely, poor quality recyclates can undermine the viability of recycling and have significant environmental and economic costs (e.g. represents a lost opportunity to recycle material and increases the need to mine and process virgin materials).
- It can help **increase public confidence and participation in recycling.** There is a certain amount of cynicism amongst the public about what happens to their recycling. Householders and businesses want to know that the action they are taking is making a genuine contribution towards protecting the environment and improving resource efficiency.
- It can help **increase the environmental benefits of recycling**. Lower contamination levels in recyclates will reduce the amount of waste discarded during the recycling process, which typically ends up in landfill.

4. Rationale for intervention

Legal drivers

The two main legal drivers for Government intervention are the EU revised Waste Framework Directive and the EU Waste Shipments Regulation.

Implementing the revised EU Waste Framework Directive (rWFD)

The rWFD requires us to take measures to promote high quality recycling and, to this end, to set up separate collections of waste to meet the necessary quality standards for the relevant recycling sectors.

The Government supports the objectives of the rWFD but believes there should be flexibility about the choice of collection system employed in any given area as each system has its strengths and weaknesses. However, if collection systems other than separate collection, involving some degree of co-mingling, are employed then it is important they deliver the requirements of the rWFD and promote high quality recycling.

The regulatory proposal is part of our approach to implementing the "separate collection" requirement of the rWFD and represents the minimum necessary to achieve compliance (i.e. it is not gold-plating). It will help ensure co-mingled collections and MRFs are producing, and have the information to demonstrate they are producing, recyclate of sufficient quality to meet the needs of reprocessors.

Implementing the EU Waste Shipments Regulation

The UK needs to meet the requirements of the waste shipment controls. It is illegal to export waste for disposal,[4] but the controls allow for so-called "green list" recyclates to be exported for recovery overseas in a manner that represents a broadly equivalent standard of environmentally sound management. Recyclates can only be exported as "green list" if they are classifiable under one entry under Annex II (Green List) of the Waste Shipment Regulations. This effectively means that no further sorting is necessary to separate out different entries in the Green List once it reaches its overseas reprocessing facility – e.g. paper being exported for recovery should not require further sorting, and as such should not include other materials such as glass, metal or plastic. The export of such recyclate does not require notification to the Environment Agency (EA), but paperwork accompanying the shipment must be completed by the person or company exporting the recyclates.

Exporting recyclate contaminated to the extent that any would need to be disposed of in the receiving country or pre-sorted before recycling, would mean that we were exporting our rubbish for someone else to deal with. Exports for disposal are prohibited, so if a significant amount of the shipment would need disposing of, this would be banned. Some countries may not have the equivalent controls on wastes that are disposed of, leading to pollution. Consequently the environmental externalities – such as the cost of disposal, where in the UK this is captured by the landfill tax – would not be captured. Such exports are illegal and the EA will take action against such activity.

The regulatory proposal aims to provide the Environment Agency with access to information which will help them identify, and take effective action against, those not complying with the law. This will increase both confidence that exports of dry recyclates are legitimate and confidence of level playing field.

[4] Exports for disposal are prohibited save for the exceptions identified in the UK Plan for Shipments of Waste.

Market failures

Recycling policies have traditionally addressed the market failure related to the environmental externality. The developing markets for recycled materials can also be subject to non-environmental market failures and barriers, such as imperfect information, market power and transaction costs which impede the smooth functioning of markets. Evidence (Improving Recycling Markets, OECD 2006) shows that presence of non-environmental market failures reduces efficiency of recycling activities and there is a potential case for intervention.

As mentioned previously, many MRFs do not assess the quality of the recyclable material they produce. This is due to competitive pressure on operating costs. Of those MRFs that do measure quality, very few are transparent about this information due to concerns about revealing information that competitors may capitalise on. Consequently, there is a lack of robust and consistent information on quality of outputs.

In a market where there can be a wide variation in quality, and if it cannot be immediately identified at the point of purchase, there can be impediments to improving market efficiency. A lack of flow of information through the recycling supply chain can also impede development of the market. Some parts of the of the recycling supply chain are not wholly incentivised to ensure the efficiency of the collection and recycling process and maximising revenue relative to costs. For example, most local authorities are charged a fixed gate fee per tonne of material sent to a MRF and therefore do not routinely request this information. In a market with an export outlet for a range of quality of recyclate, some reprocessors accept a range of quality, despite preferences for higher quality recyclate.

In the worst case a lack of information can cause a bias towards lower quality. This occurs if customers are only willing to pay a lower price, regardless of quality as they would rather not risk overpaying. At the same time sellers may not be willing to produce higher quality material if they are not certain that it will fetch a higher price. This lack of information for buyers and sellers creates a bias towards lower quality output, even though both parties could benefit from selling higher quality output. For example, the sellers could obtain a higher price, and the buyers would receive more recovered material in each batch thus reducing the volume of material that would need to be processed and potentially delivering efficiency gains. This market failure leads to market inefficiency, as both parties could see an improvement in their revenue and/or costs from a move to higher quality recyclate.

The regulatory proposal aims to address this market failure by making it mandatory for MRFs to measure recyclate quality, and to make this information transparent.

Alternatives to regulation

A voluntary approach has been attempted by the waste management industry already. The mandatory option being consulted upon, builds upon the provisions of the existing ‘Recycling Registration Service’ (RRS) which was launched in April 2007 by the Environmental Services Association (ESA), the trade association for waste management companies. The RRS established similar monitoring requirements, but it failed to attract significant uptake (only about 20 MRFs, 15% of total MRFs).

Feedback to the ESA from its members suggest that the main reason for its failure was because it was a voluntary scheme; many MRF operators felt compliance with the code would leave them at a competitive disadvantage. Industry needs assurance of a level playing before they are willing to invest in the quality assurance programmes required by the code.

The Government has worked closely with stakeholders from across the supply chain in developing the policy proposals. A series of events were held earlier this year, involving local authorities, MRF operators and reprocessors, to discuss drafts of the QAP and MRF regulation.

The majority of stakeholders present at the events supported the vision set out in the QAP, and all agreed to the principle that MRFs must measure quality and that this requirement must be made mandatory if it is to work. MRF operators see the value in measuring quality as it helps protect the image of their industry and root out illegitimate operators. However, they have been clear that the requirements will not be implemented unless they are made mandatory as they are concerned they would otherwise be undercut by competitors.

Summary

In order to stimulate the market conditions necessary to realise an improvement in quality of recyclates, and support the objective in the rWFD to promote high quality recycling, MRFs need to measure and report the quality of their input, residual and output material. Robust, consistent and transparent information on quality will help:

- Government demonstrate that it is meeting its commitments under the rWFD.
- MRFs manage quality effectively and react efficiently to prevailing market demand.
- Reprocessors identify suppliers of higher quality recyclates, reducing additional costs arising from further sorting, damage to machinery, and the disposal of unrecyclable material to landfill.
- Local authorities to make adjustments to their collection systems, provide further advice or information to householders and businesses if there are particular issues with quality, and decide which MRF to contract with.

Government is minded to make the requirements to monitor quality mandatory to demonstrate compliance with the rWFD objective to promote high quality recycling and the separate collection requirement. Mandatory requirements will provide MRF operators with the level playing field they need to invest in the quality management systems, and share information with reprocessors, without fear of being put at a competitive disadvantage.

The proposed regulations will make it a requirement for MRFs to put in place robust quality management systems and checks which will yield information on the levels of non-target and non-recyclable material contained in the inputs and outputs to the facility by material type (i.e. paper, glass, plastic and metal). The requirements would be limited to just those permitted MRFs with an output of more than 1000 tonnes per annum (i.e. 74 MRFs[5]).

Through the consultation, we are seeking views on our proposal to make requirements to monitor and report quality mandatory, whether alternative/additional interventions could improve the transparency of information and quality of recyclates (e.g. voluntary schemes, minimum standards), and the assumptions that underpin our cost-benefit analysis.

5. Description of options considered

The impact assessment considers two options:

Option 0 - do nothing, so maintaining the status quo, not introducing the proposed changes

Option 1 - introduce a mandatory requirement on MRFs, via an amendment to the Environmental Permitting Regulations, to monitor the quality of their input and output material streams.

6. Costs and Benefits

[5] Data source: Envrionment Agency permitting database 2010/11. We are aware that other classification of MRFs can result in different figures. We are working with WRAP and the EA to ensure the scope of the regulations is appropriate and this figure may be altered for the final impact assessment.

This policy is aimed at MRFs that primarily deal with municipal co-mingled material. The number of MRFs, based on permitted data 2010/11, is estimated as 87 MRFs in England and 13 in Wales with an estimated 2,385,000 tonnage throughput.

Option 0: Do Nothing

The MRF Quality Assessment Survey is the most recent comprehensive source of evidence and forms the basis for estimating the do nothing scenario. In the absence of government intervention, it is assumed that the number of MRFs monitoring quality remains at 20% as there are no further measures that are likely to incentivise take up, and feedback from MRFs has been that there will be no further take up in the absence of regulation.

The industry is expected to continue to produce the range of quality of output, and that there will be combination of domestic and overseas demand for recovered material sufficient to maintain the current trend. There are reported measures being taken in some countries to increase the quality of material imported. It is possible that there may be external drivers to improve quality. However, it is difficult to project the long term impact of any reported initiatives and therefore it is assumed that current demand and supply conditions will prevail over the longer term.

Option 1: Regulation of the MRF code of Practice through Environmental Permitting

The number of MRFs in scope is based on permitted data 2010/11 and covers 62 MRFs in England and 12 in Wales with an estimated 2,375,000 tonnage throughput. According to our figures, the numbers of MRFs that are not captured by the regulations are: 25 facilities in England, which account for around 9,000 tonnes, and 1 facility in Wales, which accounts for 700 tonnes. Therefore as a proportion of the total waste, these facilities account for less than 0.5% of the tonnage of dry recyclates in England and Wales. This demonstrates that it is not proportionate to include these facilities in the scope of the regulations.

Table 2: Classification of sites in England and Wales by size and number needing to implement

Number of MRFs	Small	Medium	Large	Total
England	41	18	3	62
Wales	10	2	0	12
Total	51	20	3	74

Table 3: Number of MRFs already implementing and estimated number needing to implement regulations

MRFs already implementing:	Small	Medium	Large	Total
England	8	4	1	13
Wales	2	0	0	2
Total	10	4	1	15
Number of MRFs needing to implement	Small	Medium	Large	Total
England	33	14	2	49
Wales	8	2	0	10
Total	41	16	2	59

As described above, output of those MRFs in scope is estimated at 2.375m tonnes in 2011 (source, WRAP). The growth rate is estimated to range between 0-5% (2.5% best estimate). Waste arisings, household recycling rate and collection method (kerbside sort or co-mingled) all interact to influence the amount of co-mingled municipal waste requiring sorting by a MRF. In the absence of government intervention, the level and range of quality of MRF output is not expected to change. The Quality Assessment Study found no causal relationship between quality, and the age nor size of MRF.

Table 4: Estimated growth in tonnage throughput of MRFs in scope

Total MRF input tonnage	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
low estimate (no growth)	2.375	2.375	2.375	2.375	2.375	2.375	2.375	2.375	2.375	2.375
Best estimate	2.496	2.562	2.630	2.703	2.778	2.858	2.941	3.029	3.121	3.218
high estimate (5% growth)	2.618	2.749	2.886	3.031	3.182	3.341	3.508	3.684	3.868	4.062

It is assumed that initial costs of sampling and monitoring will be in 2013, in order to comply with the policy in 2014. One-off costs to business are the acquisition of testing equipment, systems costs and the need for an initial audit of sampling. Annual costs relate to the requirement to sample input and output material to a given frequency and are based on estimates from WRAP and the Environmental Services Association, calculated for three size bands of MRFs. It is assumed that 20% of MRFs undertake sampling to the specification described already (primarily those which participated in the voluntary agreement). A further 50% of MRFs are assumed to undertake some type of monitoring (source: WRAP) and expected to incur half the estimated costs. An annual audit by an independent third party is required for all MRFs.

Introduction of this proposal and associated measures is expected to increase the availability of information about the quality of MRF output. Although there are initial costs to business of this measure, there are potentially greater benefits of higher quality recycling from avoided embedded GHG emissions from a greater tonnage of material being recycled (see Section 8).

One off costs

It is estimated that half of the MRFs that are not implementing the Recycling Registration Service (RRS) are performing some monitoring of output, and incurring half of the estimated one off and annual costs as described here. The remaining 50% of MRFs that are not currently implementing the RRS are expected to incur the full costs of the measure. All businesses are expected to incur the cost of the annual audit.

WRAP and the Environmental Services Association (ESA) have provided estimates of costs related to sampling and adopting IT systems to measure the quality of outputs. The MRFs have been classified as small (less than 5,000tpa throughput), medium (between 20,000 and 75,000tpa) and large (over 75,000tpa). Depending on the size of MRF it is expected there will be one off costs to equipment such as weigh scale, mesh sorting table and input and sorting bins. Details are provided in Annex 1.

Auditing is expected to be performed by the ESA. It may be necessary to install the required IT systems to ensure consistency across the sector. The figures below show ESA estimates of cost relating to installing IT systems and a one off pre-entry audit are also expected to be incurred. The pre-entry audit is expected to be an opportunity to receive advice on measuring and performing sampling.

Table 5: Estimate of maximum one off costs to business by size of MRF

Size of plant	Small	Medium	Large
One off equipment costs £	6,500	7,200	8,400
Pre entry audit £	1,250	1,250	1,250
Management systems £	2,500	11,875	28,125
Total one off costs £	**10,250**	**20,325**	**37,775**

The policy is expected to be required from 2014 and one off costs are assumed to be incurred in 2013. The range of estimate takes into account new businesses over the period of analysis that are expected to incur the costs of this policy. The total one off costs of the policy in 2013 are below:

Table 6: Central estimate of total one off equipment costs

	Small	medium	large	total
one off equipment costs £	6,500	7,200	8,400	
Number of sites	41	16	2	59
Total one off equipment costs £	266,500	115,200	16,800	398,500
Total one off equipment costs assuming 50% already incurring 50% of costs	199,875	86,400	12,600	298,875

Costs of training for sorting and sampling are not taken into account separately here as it is assumed this will be undertaken as part of the pre entry audit and setting up the management systems (Table 5 provides costs).

Annual costs

Annual costs relate to the cost of taking input and output samples, sorting and recording data. The sampling frequency and associated costs are shown below. Annual costs are estimated by WRAP.

Table 7: Sampling frequency for MRFs

Size of plant/sampling frequency	Small	Medium	Large
Weekly sampling frequency: inputs	2	5	10
Weekly sampling frequency: outputs	14	28	62

The costs of sampling are calculated based on employee rates and estimated time taken to separate out and sort samples, sampling and recording of data. A detailed breakdown is in Annex 1.

The annual audit would be expected to last all day with a manager using approx. 3 hours of time and various staff spending 15 minutes to respond to auditor questions for the material testing element. The estimate of cost is based on estimates from WRAP and ESA.

Table 8: Central estimate of annual costs to business by size of MRF

Costs/Size of plant	Small	Medium	Large

Annual labour cost £	12,010	25,301	54,650
Annual audit £	1,250	1,250	1,250
Total annual costs £	**13,260**	**26,551**	**55,900**

Table 9: Central estimate of total annual labour costs, assuming 50% of MRFs already incurring 50% of costs.

	Small	Medium	Large	Total
Annual labour costs	12,010	25,301	54,650	
Number of sites	41	16	2	59
Total annual labour cost	492,410	404,816	109,300	1,006,526
Total annual costs assuming 50% already incurring 50% of costs	**369,308**	**303,612**	**81,975**	**754,895**

For the total annual costs, we have placed a range of 25% around the central estimate as there is uncertainty over actual costs incurred and changes in those costs over time. The full impact of auditing costs are shown separately here as they are incurred by all MRFs, even if they were already implementing the RRS.

Table 10: Central estimate of total auditing cost incurred by all MRFs

£	small	medium	large	total
Pre entry audit £	1,250	1,250	1,250	
Management systems £	2,500	11,875	28,125	
Total one off cost per site £	3,750	13,125	29,375	
Annual audit £	1,250	1,250	1,250	
Number of sites	41	16	2	59
plus sites already implementing requiring audit only	10	4	1	15
Total one off auditing costs £	166,322	214,580	60,000	440,902
Total annual costs	63,822	24,580	3,750	92,151

Summary of costs

The impact on business is £0.8m initial costs (£0.5m-£0.9m) of purchasing new equipment for sampling, installing IT systems and performing a pre-entry audit for existing businesses and new business entrants. Annual costs of sampling and an annual audit are assumed to impact on businesses directly and estimated at £7.4m PV annual costs (£5.6m -£9.3m range of 25%) over 10 years. The total impact on businesses is £8.2m (£6.1m - £10.3m) PV over 10 years. These are the direct costs of the policy and are included in the summary sheets.

The costs of regulation could be passed on through the recycling supply chain to local authorities, who pay for the services from MRFs in the form of higher gate fees. The anticipated higher prices for recyclate paid by reprocessors, who purchase the output of MRFs, could also help cover the costs of regulation. The actual impact is expected to be small as the costs per MRF are estimated to be very low relative to other costs and turnover. Further, it is expected that this additional cost will help drive an improvement in efficiency in the recycling supply chain which could be expected to improve efficiency. For example, if a MRF is receiving recovered material that has high contamination rates, it may be incentivised to communicate with LAs to try and reduce those rates. In turn, if a reprocessor is receiving material of lower quality, and has information about other material that is of the preferred quality, it may change contracts or try and negotiate for higher quality output. In some cases, there may be no change in the supply chain at all, but all the parts of the chain have better information to make decisions.

7. Non monetised costs

It is expected that MRFs will submit the information to the EA and the EA will manage access to the information. Additional EA time above permitting may include dealing with MRF queries and isolated instances of non-conformance. Costs to the Environment Agency of monitoring and management of information have not been monetised at this stage but information will be sought at consultation.

There is also the opportunity, at the cost of permit variation, for facilities to reduce the prescribed testing frequency if they can demonstrate to the regulator a high degree of consistency in the composition of their output materials. The draft regulations limit the reduction in sampling frequency to a minimum of one sample per week. Further information on the potential take up rate and associated costs and benefits of this lower risk regime are being sought during the consultation process and will be monetised in the final impact assessment.

8. Potential wider impacts of measuring quality

The Wales Quality Thresholds Scoping Study – Background Report states ‘there was general consensus from stakeholders that, by introducing more transparent testing and reporting systems within the supply chain, the quality of recyclates would improve, even if thresholds were not set’. It goes on to state that increased quality and pricing could be expected, but could not be quantified. The analysis set out below attempts to consider a scenario of behaviour change resulting from the proposed regulations. The costs and benefits analysed here are not included in the summary sheets of the impact assessment due to the uncertainty of the scale of behaviour change.

The availability of robust information on quality and associated measures could drive behaviour change in reprocessors. Those reprocessors receiving low quality recyclate, would now have robust, readily available information on the range of quality of feedstock available to them and may seek to change some supplier contracts. It assumes a small shift by these customers can trigger lower quality MRFs to take measures to improve quality or face a potential loss of customers. This analysis assumes there will still be a range of quality of recyclate, but those customers unhappy with receiving the lowest quality will have sufficient information to confidently shift to other MRFs.

One potential scenario of an improvement in quality is analysed here, and in further detail in Annex 3.

As a result of the proposed amendment and additional measures, a small proportion of lowest quartile MRF customers (10% assumed) could be expected to shift to the upper quartile in terms of quality, as they can directly benefit from such a move through higher yield and reduced landfill costs of the contaminated percentage that cannot be used. This shift (2.5% of total output) is assumed to occur relatively rapidly as there are a proportion of reprocessors with flexible contracts and who deal on the spot market. Contracts between collection bodies and MRFs are long term (between 6-20 years) but there is a proportion of the market that is not fixed into these contracts. This actual or potential loss of customers gives an incentive for lower quality MRFs to increase the quality of their outputs, either by improving input quality or investing to improve sorting processes/slowing down plant throughput. It is assumed there will be a shift by the remainder of MRFs in this quality segment (22.5% of output) to the average quality of the sector. This should reduce the overall amount of MRF input that ends up in landfill be that in England or overseas, (assuming the higher quality MRFs have a lower non-target and non-recyclable rate) and also increase the total amount of value (both environmental and economic) gained from recycling the material for the industry as a whole (prices are assumed to reflect the reduction in non-target and non-recyclable rate). A greater amount of material recycled also benefits society through reduced greenhouse gas emissions from landfill and avoided embedded emissions. An increase in total production of recyclate is assumed to be absorbed by the reprocessing market without an impact on material prices as there is anecdotal evidence of a shortage of supply and prices are influenced by global conditions and production activity.

The methodology for the cost benefit analysis from an improvement in quality of recyclate is taken from Porter (Waste Economics Ch 9, citing Ackermann 1997) and calculates the net impact of a shift of material from landfill to recycling as:

Table 11: Impact of a shift of material from landfill to recycling

Benefits	Costs	Source
Additional revenue from recyclate, calculated using the differential in material compositional analysis in lower, and upper quartiles and average quality and applying the relevant material price to calculate the aggregate improvement in recovered material revenue		Tonnage estimated using WRAP MRF Quality Assessment mid point of quartile ranges. Material prices: Let's Recycle 2012
Avoided gate fee and haulage of sending less material to landfill	**Costs of collection of material for recycling** (in this case zero if the increased quality results from better sorting at MRFs)	WRAP Gate Fees report 2011, estimate of haulage costs (WRAP)
Additional carbon benefit of avoided virgin material extraction, calculated applying carbon factors to the avoided production for each material	**Carbon cost of recycling material** calculated by applying the carbon factor for recycling activity	Scottish Carbon Metric, DECC traded and non traded carbon prices

The lack of disclosure on contractual arrangements between MRF and reprocessors results in a lack of detailed evidence of the relationship between price and quality of recyclate. Anecdotal evidence from reprocessors indicates they are willing to, and do pay for higher quality. In addition, given a higher quality material will have a higher output yield for the reprocessor, theoretically the reprocessor should be willing to pay more for higher quality when it is clearly identifiable. The evidence from WRAP shows there is a range of quality. The existing voluntary RRS should have been an opportunity for businesses in the higher quartile to distinguish themselves and achieve a higher price. It is unclear why those who did measure quality did not reveal it, but it is possible that uncertainty due to imperfect information across the whole sector was an impediment to this. By requiring consistent information, these proposed regulations should remedy this.

In markets where there is quality measurement and a grading system, such as in some scrap metal markets, publicly available data (e.g. London Metal Exchange) shows a relationship between price and quality. The relationship between price and quality can be undermined by lack of consistent information on quality. It is assumed that only the marginal increase in recovered material received by those customers that switch MRF receives a higher price. It is estimated that a small shift of buyers from the lower quartile to the upper quartile of producer of quality generates benefits both from more revenue for higher quality material and a reduced contamination rate that sends less material to landfill. This scenario assumes that the supply chain can adjust to changes in demand, which given the small percentage change and existence of some flexible contracts may be a reasonable assumption. As the total volume through the sector is not expected to change, costs of increasing throughput for the high quality MRFs is assumed to offset the reduction in costs related to lower throughput at the lower quality MRFs. It is possible the high quality MRF will face higher costs of operation, but given the small amount of volume that is assumed to shift (2.5% of total) and the high proportion of fixed costs at a MRF, it is difficult to estimate the specific cost differential.

At this stage, it is expected that reprocessors will benefit from the reduced cost of landfill gate fees and also benefit from improved plant efficiencies related to having higher quality throughput. This benefit has not been monetised, but it is expected that the benefit of reduced landfill costs and improved efficiencies are more than paying for higher quality material.

Table 12: Potential benefit from a shift of 2.5% of customers from the lower quartile to the upper quartile of quality (further detail in Annex 3, Table 7)

Benefits of shift of 10% of customers from lower to higher quartile	Benefits to business: avoided landfill gate fees[6]	Benefits to business: increased material revenue	Benefits to society: reduced greenhouse gas impacts	Total benefit
£m 10 year NPV	£0.9m-£1.3m	£3.2m-£7.6m	£1.6m-£2.1m	£5.7m-£10.9m

Table 13: Potential benefit of a further shift by 22.5% of total capacity from lower quartile to average quality of sector (further detail in Annex 3, Table 9).

Benefits of shift of 22.5% of tonnage from average of lowest quartile to average quality	Benefits to business: avoided landfill gate fees	Benefits to business: increased material revenue	Benefits to society: reduced greenhouse gas impacts	Total benefit
£m 10 year NPV	£3.8m-5.7m	£14.1m-£35.6m	£5.7m-£8.7m	£23.6m-£50.1m

Taking into account the initial and on-going costs to business of sampling and testing the net benefit to society of this scenario over 10 years is £30.9m (£13.1m - £51.5m) PV. This breaks down into initial cost to business of £0.8m (£0.5m-£0.9m) and £12.1m (£9.0m-£15.1m) PV annual costs to business over 10 years for sampling and investment to improve quality. The costs to business are expected to impact directly on MRFs, but the costs could be expected to be passed on partially through gate fees and also incorporated in prices for recyclate sold to reprocessors. To the extent that the Producer Responsibility Note system acts as a 'top up' between the cost of sending material to landfill and the cost of recycling, this cost may affect PRN prices. Total benefits over 10 years are estimated as £34.6m (£22.0m-£50.2m) PV to business and £9.0m (£7.2m-£10.8m) PV of lower greenhouse gas emissions resulting in a net benefit of £30.9m (£13.1m-£51.5m) PV over 10 years, As there is uncertainty on the scale of benefits calculated, they have not been included in the summary sheets, although the intended impact of the measures in the revised Waste Framework Directive are to deliver the benefits of high quality recycling. See Annex 3 for a detailed breakdown of costs and benefits.

The potential impact of better feedback of information back through the recycling chain to Local Authorities and householders has not been monetised. Better information may lead to higher quality of inputs into the sorting process. The greater availability of information on outputs and therefore potential revenue could result in more revenue sharing contract between local authorities and MRF operators which will help to align incentives to improve both the quality of input material and the efficiency of MRF operations. It is also assumed that higher prices paid for higher quality material reflect the improvement in efficiency at reprocessors from having better feedstock. It is possible there are wider benefits to reprocessors such as reduced front end costs that have also not been monetised here. Reprocessors have commented that the lack of availability of high quality feedstock has been one of the barriers to future investment in the sector.

The total impact on business is £0.8m initial costs (£0.5m-£0.9m) and £12.1m annual costs (£9.3m -£15.5m). Benefits from the scenario given are estimated as £34.7m (£22.0m-£50.2m) to business (higher material revenue and lower landfill costs) and £9m (£7.2m-£10.8m) of lower greenhouse gas emissions resulting in a net benefit of £30.9m (£13.1m-£51.5m) to society. As there is uncertainty over the expected benefits, the figures have not been included in the summary sheets. It is expected the package of measures could influence actors along the supply chain and the impact is difficult to pinpoint. The consultation period will be used to

[6] Landfill gate fees are estimated £20 per tonne and haulage £10 per tonne (source WRAP)

gather further evidence on the expected impacts and consideration of the most cost effective way of improving the quality of reyclates.

9. Equivalent Annual Net cost to Business

The total costs to business of implementation of the regulations are calculated as £8.2m PV (£6.1m - £10.3m) which gives an EANCB of £0.90m (£0.67m - £1.13m).

10. One in One Out

The MRF Regulation is the minimum necessary to comply with the separate collection requirement of the rWFD (see Section 4.1 for further information). Therefore it is not gold-plating and is not within the scope of OIOO.

11. Small firms impact test

In developing the regulatory proposals, the Government took steps to ensure that SMEs would not incur disproportionate costs. These included:

- limiting the scope of the requirements to just those permitted MRFs with an output of more than 1000 tonnes per annum, the effect of which is to exempt 25% of MRFs in England and Wales but less than 0.5% of the total tonnage of dry recyclate handled every year.
- linking the sampling frequency to the tonnage throughput, with smaller MRFs required to sample less often which reduces their operational costs. Tables 5 and 8 within this IA identify the costs to business by size.

The Government engaged with representatives of SMEs, and operators of small MRFs, during the development of the regulatory proposals in particular those aspects which are intended to ensure SMEs will not incur disproportionate costs. The Government will continue to consider the impact on SMEs of the regulatory proposals during the consultation process. The consultation document, for example, asks for views on whether the 1000 tonne per annum deminimis has been set at the correct level and whether the proposed sampling frequencies are proportionate.

Microbusiness Exemption Rule: Under the microbusiness exemption rule whereby regulation exempts organisations of 10 or fewer employees and start-ups, this measure is out of scope because it relates to implementation of an EU Directive.

Annex 1: Detailed estimate of costs

Table a: one off equipment costs (source: WRAP estimates)

ITEM	Small MRF	Medium MRF	Large MRF
Input Bin	1 x £200	2 x £200	3 x £200
Weigh Scale	1 x £5000	1 x £5000	1 x £5000
Mesh Sorting Table	1 x £500	1 x £500	2 x £500
Sorting Tables	1 x £300	2 x £300	3 x £300
Sorted Material Bins	25 x £20	35 x £20	45 x £20
TOTAL £	**£6500**	**£7,200**	**£8,400**

Table b: annual labour costs for sampling (source: WRAP estimates)

ITEM	Small MRF	Medium MRF	Large MRF
Take Input sample	100 samples x £7 x 0.5 hr = £350	250 samples x £7 x 0.5 hr = £875	500 samples x £7 x 0.5 hr = £1750
Grab operator	100 samples x £7 x 0.5 hr = £350	250 samples x £7 x 0.5 hr = £875	500 samples x £7 x 0.5 hr = £1750
Sort input sample	100 samples x £7 x 1.5 hr = £1050	250 samples x £7 x 1.5 hr = £2625	500 samples x £7 x 1.5 hr = £5250
Record data/admin	100 samples x £7 x 0.25 hr = £175	250 samples x £7 x 0.25 hr = £438	500 samples x £7 x 0.25 hr = £875
Take output samples	700 samples x £7 x 0.5 hr = £2450	1400 samples x £7 x 0.5 hr = £4900	3100 samples x £7 x 0.5 hr = £10,850
Sort output samples	700 samples x £7 x 0.7 hr = £3430	1400 samples x £7 x 0.7 hr = £6860	3100 samples x £7 x 0.7 hr = £15,190
Record data/admin	700 samples x £7 x 0.25 hr = £1225	1400 samples x £7 x 0.25 hr = £2450	3100 samples x £7 x 0.25 hr = £5425
TOTAL HOURS	**1290 hours or 1 man for 32 weeks pa**	**2718 hours or 2 man for 34 weeks pa**	**5870 hours or 3 men for 49 weeks pa**
SUB COST	£9,030 pa	£19,023 pa	£41,090 pa
COST inc overheads	**£12,010 pa**	**£25,301 pa**	**£54,650 pa**

Annex 2: Detailed estimate of annual costs

Table a: One off costs

	Low estimate (-25%)	Central estimate	High estimate (+25%)
one off equipment	224,156	298,875	373,594
one off auditing	330,676	440,901	551,127
total one off costs	554,832	739,776	924,720

Table b: Annual costs

	Low estimate (-25%)	Central estimate	High estimate (+25%)
annual labour costs	566,171	754,895	943,618
annual audit costs	69,113	92,151	115,189
total annual costs	635,284	847,046	1,058,807
PV annual costs	593,038	790,717	988,397

Table c: Annual impact of central estimate for costs for 0% growth scenario, all values £m

Growth in sector	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Annual labour costs	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	6.79
Annual audit costs	0	0	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.83
Total annual costs	0	0	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	7.62
PV annual costs	0	0	0.79	0.76	0.74	0.71	0.69	0.67	0.64	0.62	0.60	6.23

Table d: Total impact of central estimate of costs for 5% growth scenario

Growth in sector	0	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
annual labour costs	0	0.00	0.83	0.87	0.92	0.96	1.01	1.06	1.12	1.17	1.23	9.18
annual audit costs	0		0.10	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.15	1.12
total annual costs	0	0.00	0.93	0.98	1.03	1.08	1.14	1.19	1.25	1.31	1.38	10.30
PV annual costs	0	0.00	0.90	0.92	0.93	0.94	0.96	0.97	0.98	1.00	1.01	8.61

The best estimate is the mid-point of these 2 ranges.

Annex 3: Detailed analysis of wider impacts of MRF Regulation

This scenario analysis was conducted on the basis of assumptions made below. It is possible that the measures proposed do not deliver the exact benefits as described and therefore are not included in the summary sheets of this IA.

Quality of output material from MRFs

WRAP undertook a material testing exercise at around 20% of UK municipal MRFs in 2009 – the results of this exercise are shown in Table 1. The percentages shown in the table indicate contamination levels. To note, contamination:

- for 'input material' will consist of material not accepted by the MRF (e.g. material the householder should not have put in the recycling bin);
- for 'output material' will consist of material not accepted by the MRF (i.e. the MRF has failed to sort and remove those materials the householder should not have put in the recycling bin) and material that is non-target but may still be recyclable (e.g. metal cans are recyclable but the MRF has failed to fully sort them from an output of paper);
- for 'residual output' will consist of target material that the MRF failed to identify.

In all instances, the lower the percentage the better. The best performing 25% of MRFs, in terms of material quality, are in the lower level quartile column.

The results suggest there is a wide range of quality and that few MRFs are currently able to meet the highest level of quality demanded by industry standards, particularly for paper and plastics.

Table 1: Contamination levels in the input, output and residual material streams of MRFs

Material Stream	Lower Level Quartile	Median Level Quartile	Upper Level Quartile
Input Material			
All	< 6.4%	6.4% to 17.5%	> 17.5%
Single-stream	< 8.4%	8.4% to 17.5%	> 17.5%
Two-stream – Fibre based	< 2.9%	2.9% to 9.0%	> 9.0%
Two-stream – Container based	< 4.9%	4.9% to 22.6%	> 22.6%
Output Material			
Aluminium	< 0.9%	0.9% to 4.6%	> 4.6%
Steel	< 2.8%	2.8% to 7.1%	> 7.1%
News and PAM	<4.6%	4.6% to 15.0%	> 15.0%
Mixed Paper	< 3.2%	3.2% to 25.3%	> 25.3%
Card	< 4.8%	4.8% to 12.0%	> 12.0%
Mixed Plastic	< 6.9%	6.9% to 26.6%	> 26.6%
Mixed Plastic bottles	< 8.3%	8.3% to 16.2%	> 16.2%
HDPE Coloured Plastic Bottles	< 6.9%	6.9% to 11.3%	> 11.3%
HDPE Natural Plastic Bottles	< 1.9%	1.9% to 4.0%	> 4.0%
PET Clear	<2.6%	2.6% to 9.5%	> 9.5%
PET Coloured	< 5.6%	5.6% to 10.7%	> 10.7%

Material Stream	Lower Level Quartile	Median Level Quartile	Upper Level Quartile
Residual			
All	< 28.3%	28.3% to 80.9%	> 80.9%
Single-stream	< 24.7%	24.7% to 61.7%	> 61.7%
Two-stream – Fibre based	< 33.0%	33.0% to 59.2%	> 59.2%
Two-stream – Container based	< 72.2%	72.2% to 88.0%	> 88.0%

For the purposes of this analysis, the data above is taken for the baseline of quality at MRFs. The study also showed that there is not a consistent relationship between quality and size nor technology. The baseline is assumed to be no change in the range of quality without intervention.

It is estimated there are 62 permitted relevant MRFS in England and 12 in Wales with tonnage throughput over 1,000tpa (tonnes per annum). Relevant MRFs are considered those receiving mainly mixed household or municipal recyclates[7]. It is further assumed that 20% of MRFs already undertake sampling to the specification required (15 MRFs), and a further 50% of MRFs are assumed to undertake some kind of monitoring and incur only 50% of the associated costs.

Output of those MRFs in scope is estimated at 2.375m tonnes in 2011. The growth rate is estimated to range between 0-5% (2.5% best estimate). Waste arisings, household recycling rate and collection method (kerbside sort or co-mingled) all interact to influence the amount of co-mingled municipal waste requiring sorting by a MRF.

Table 2: Estimate of total MRF throughput

Total MRF input (m tonnes)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
low estimate (no growth)	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38
Best estimate	2.50	2.56	2.63	2.70	2.78	2.86	2.94	3.03	3.12	3.22
high estimate (5% growth)	2.62	2.75	2.89	3.03	3.18	3.34	3.51	3.68	3.87	4.06

Scenario of benefits of an improvement in quality of recyclate

The scenario assumes benefits from an initial shift in customers are expected to accrue from July 2014. Further costs to increase quality of recyclates are not expected to occur until 2015 and benefits are expected to impact at the same time

It is expected that customers will ask for information on quality of output as current measures of quality, such as visual inspection, are less accurate. Should the information reveal that a MRF is consistently producing lower quality output, the customer is expected to require the MRF to improve quality or change contract to another MRF producing higher quality output. Higher quality output is of higher value to the customer, so it would be reasonable to 'shop around'. Given the high fixed cost and low variable costs of operating MRFs, in most cases it is more efficient to do better sorting at a MRF rather than sorting again at a reprocessor.

This scenario is modelled by assuming that 10% of customers receiving recovered material in the lower quartile of output quality will shift to those MRFs that are in the upper quartile. Given the short term and fluid nature of existing contracts, these changes are not expected to incur additional cost to normal contracting activity. Anecdotal evidence suggests there is spare capacity in the MRFs sector. Further, the cost of the increase in output at the high quality MRFs

[7] As detailed in the IA, definitional issues can lead to different figures for those MRFs in scope. Further evidence will be sought at the consultation stage to ensure the correct number of MRFs are in scope.

is expected to offset a change in costs at the more inefficient operations that have now lost a proportion of sales.

The benefits of a shift of 2.5% of customers of MRF output from the lower quartile to the upper quartile quality thresholds is expected to deliver higher material revenues and reduced residual material to landfill. The actual shift could be greater, given the wide divergence in quality. The higher quality material is expected to gain a higher price, corresponding to the increase in volume of recovered, non contaminated material, illustrated in Table 5 below. There will be an avoidance of tonnage of material sent to landfill, corresponding to the increase in material recovered. Finally society will benefit from a reduction in embedded emissions associated with virgin material extraction, net of the carbon impacts of reprocessing recovered material. The estimated material benefit is calculated by taking the difference between the materials recovered in higher and lower quartile MRFs in the WRAP MRF Quality assessment study and applying the prices for recovered material types (April 2012, source: Let's Recycle). We have assumed a 25% range around those prices to take account of volatility. The total volume for the sector is assumed at 2.375mt in 2011. Estimates of growth in the sector are difficult as they are dependent on many factors including household waste arisings, household recycling rate and type of waste collection. We have estimated growth in the sector ranging between 0 and 5% over the period of analysis.

Table 3: Estimation of increase in recyclate resulting from a shift in customer from low to high quality MRF operators

Input and contamination rates based on the MRF Quality Assessment Study					**Impact of shift of 2.5% capacity from low to high based on yields and typical input on annual throughput of 2.375m tonnes**
	MRF input %	Upper quartile threshold contamination rate%	Lower quartile threshold contamination rate%	Yield improvement of shift from low to high	Annual increase in tonnes of recyclate output (% of MRF input x yield improvement x total annual tonnage)
aluminium	4.031	0.9	4.6	3.7	89
card	14.572	4.8	12	7.2	623
glass	2.45	1.5	1.5	0	-
HDPE coloured	2.653	6.9	11.3	4.4	69
HDPE Natural	6.026	1.9	4	2.1	75
Mixed Paper	5.105	3.2	25.3	22.1	670
Mixed plastic	3.794	6.9	26.6	19.7	444
Mixed Plastic bottles		8.3	16.2	7.9	-
Newspaper	31.698	4.6	15	10.4	1,957
PET clear	6.552	2.6	9.5	6.9	268
PET coloured	1.297	5.6	10.7	5.1	39
Plastic Film	2.208	39.5	39.5	0	-
Steel	11.23	2.8	7.1	4.3	89
	91.616				**4,323**

This increase in annual tonnage is applied to the material prices in Table 4 taken from Let's Recycle April 2011 (see assumptions) and then a 25% range applied to take account of volatility in price over the 10 year period.

Table 4: Material revenue per extra tonne of material

Material	material price April 2012 £	low estimate £	high estimate £
aluminium	875	656	1094
card	85	64	106
glass		0	0
HDPE coloured	207.5	156	259
HDPE Natural	345	259	431
Mixed Paper		0	0
Mixed plastic	77.5	58	97
Mixed Plastic bottles	165	124	206
Newspaper	240	180	300
PET clear	112.5	84	141
PET coloured	310	233	388
Plastic Film	70	53	88
Steel	150	113	188
aluminium	198	149	248

The carbon impacts are calculated using the carbon factors from Scottish Carbon Metric in Table 5. Carbon prices in Table 6 apply the central estimate of the traded price of carbon to the carbon impact of recycling and the non traded price of carbon is applied to the avoided impacts from landfill.

Table 5: Carbon factors for impact of shift from landfill to recycling

	carbon factor of avoided landfill on CO2e kg/tonne	carbon factor of benefit of recycling in CO2e kg/tonne
aluminium	21	9245
card	580	219
glass	26	366
HDPE coloured	34	1901
HDPE Natural	34	1901
Mixed Paper	580	219
Mixed plastic	34	2100
Mixed Plastic bottles	34	2148
Newspaper	580	157
PET clear	34	2974
PET coloured	34	2974
Plastic Film	34	1450
Steel	21	1702

Table 6: Carbon prices

Carbon value £ per tonne CO2e	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
carbon value - traded	16	17	19	21	22	24	26	29	33	38
carbon value - nontraded	57	58	59	60	61	62	63	64	65	66

Source: DECC

Table 7: Potential benefit from a shift of 2.5% of customers from the lower quartile to the upper quartile of quality

Benefits 10 year present value	**Costs 10 year present value**
£5.1m (£3.2m - £7.5m) Additional revenue from more recyclate being sorted and sold to reprocessors (4,300-6,000 tonnes of material per year multiplied by prevailing price for each recyclate, averaging £95 per extra tonne with a 25% range for price volatility)	
£1.1m (£0.9m - £1.3m) Avoided gate fee and haulage of sending less material to landfill (4,300-6,000 tonnes per year, multiplied by £20 gate fee and £10 haulage (WRAP estimates))	**£ estimated low and not monetised** Costs of collection of material for recycling (in this case zero if the increased quality results from an equal reduction in costs at low quality MRFs and an increase in costs at high quality MRFs)
£1.8m (£1.6m - £2.1m) Additional carbon benefit of avoided virgin material extraction, net of carbon cost of recycling calculated applying carbon prices to carbon factors	**£ netted off the carbon benefit** Carbon cost of recycling material calculated by applying the carbon factor for recycling activity
Total £8.1m (£5.7m - £10.9m)	

This shift of a small proportion of customers in the industry could act as a strong incentive for the lower quality MRFs to improve output or face a signficant reduction in revenues. For the purposes of modelling here, we have assumed the lowest quartile of MRFs will invest to improve the quality of their output to the average of the sector in the MRF Quality Assessment Study. The benefit of a shift from this lowest quartile to the average of the sector is calculated using the same methodology as with the initial shift of customers.

The investment cost is estimated on the basis of advice from WRAP, using labour costs as the primary resource, although MRFs may invest in technology, or demand higher quality inputs. Estimate of the cost of increasing labour (sorters) to achieve the improvement in yield for each material. This ranges from 2-10% according to material, and averages 7% across the industry. MRFs may alternatively choose to invest in technology, slow down the speed of plants or influence input requirements through engagement with local authorities. Costs of technology or influencing collection will also incur costs, but is difficult to quantify, so a range of 25% is applied. These are assumed to be in the same range as increasing labour. There is no assumption on an improvement in quality for the rest of the sector (75%), nor of an improvement in price, although this may occur. There is a risk access to finance may impede investment in which case influencing the quality of input may occur. Benefits of a shift from the average of lower quality to average quality and are calculated in the same way as above.

These costs are applied to the estimate of the improvement in quality required to improve the tonnage throughput to the yields in Table 10. A range of 25% is used around the estimates as there is limited evidence on the exact costs that may be incurred. Costs to increase quality for the MRFs accounting for 22.5% of the lowest quartile of output quality is estimated as £3.4m-5.9m NPV over 10 years.

The total tonnage increase from an improvement in sorting following increased investment to increase throughput yields is 88,600 tonnes per year (assuming 2.375m total tonnage throughput) which is a 3.7% increase in overall amount of recovered material.

Table 8: Estimation of increase in recyclate resulting from lower quality MRFs investing to improve quality to the average yield for each material

Input and contamination rates based on the MRF Quality Assessment Study					**shift of 22.5% capacity from low to high based on yields and typical input on annual throughput of 2.375m tonnes**
Material	MRF input %	average contamination rate %	bottom quartile contamination rate %	improvement in yield from shift from low quality quartile to average	Annual increase in tonnes of recyclate output (% of MRF input x yield improvement x total annual tonnage)
aluminium	4.031	2.5	4.6	2.1	2,010
card	14.572	12	12	0	-
glass	2.45	1.5	1.5	0	-
HDPE coloured	2.653	8.7	11.3	2.6	1,638
HDPE Natural	6.026	4.5	4	-0.5	
Mixed Paper	5.105	15.8	25.3	9.5	11,518
Mixed plastic	3.794	12.2	26.6	14.4	12,975
Mixed Plastic bottles		18.2	16.2	-2	-
Newspaper	31.698	9.8	15	5.2	39,147
PET clear	6.552	7.5	9.5	2	3,112
PET coloured	1.297	8.1	10.7	2.6	801
Plastic Film	2.208	9.5	39.5	30	15,732
Steel	11.23	6.2	7.1	0.9	2,400

The avoided GHG emissions benefits and material revenue benefits are applied to the tonnage above, taking into account the different growth scenarios. The summary is in the table below.

Table 9: Estimated impact of an improvement in quality by MRFs accounting for 22.5% of total output in the lowest quartile

Benefits 10 year PV	Costs
£23.6m (£14.1m - £35.6m) Additional revenue to MRFs from more recyclate being sorted and sold to reprocessors (19,900-29,500 average tonnes per year multiplied by prevailing price for each recyclate, averaging £95 per extra tonne with a 25% range for price volatility)	£4.6m (£3.4m - £5.9m) Increase in labour/investment costs/slower operation of machinery, assuming 25% range (averages £538,000-£897,000 per year).
£4.8m (£3.8m - £5.8m) Avoided gate fee and haulage of sending less material to landfill (19,900-29,500 average tonnes per year multiplied by £20 gate fee and £10 haulage (WRAP estimates))	Costs of collection of material for recycling - this is an alternative to improving quality through sorting and therefore assumed to be covered in the costs above. In reality, there may be a mix of improved sorting and other measures to improve quality of output.
£7.2m (£5.7m - £8.7m) Additional carbon benefit of avoided virgin material extraction, calculated applying carbon factors to the avoided production for each material	£ netted off the carbon benefit Carbon cost of recycling material calculated by applying the carbon factor for recycling activity
Total £35.6m (£23.6m - £50.0m)	Total £4.6m (£3.4m - £5.9m)
Total net benefit of investment stage: £31.0m (£17.7m - £44.6m)	

Table 10: Total estimated impacts of this scenario are:

Costs of implementing measuring and sampling	Costs of investment to improve quality	Total costs	Benefits to business: increased material revenue	Benefits to business: avoided landfill gate fees[8]	Benefits to society: reduced greenhouse gas impacts	Total benefit	**Net benefit**
£ 10 year PV basis							
£8.2m (£6.1 - £10.3m)	£4.6m (£3.4m-£5.9m)	£12.8m (£9.5m - £16.2m)	£28.7m (£17.3m - £43.1m)	£5.9m (£4.7m - £7.0m)	£9.0m (£7.3m - £10.8m)	£43.7m (£29.3m - £61.0m)	**£30.9m (£13.1m-51.5m**

Key assumptions:

The greenhouse gas impacts have been calculated using the updated central non traded price of carbon (DECC, October 2011) for avoided landfill emissions and the traded price of carbon for impacts related to the benefit of recycling over using virgin material (source: Scottish Carbon Metric).

It is assumed up to half of MRFs are engaging in some sort of quality monitoring and may be incurring half of the costs estimated for sampling. Material prices are based on April 2012 figures for recovered material from Let's Recycle. A range of 25% around these figures is assumed to take account of cyclicality in prices over the period of analysis.

Landfill tax is not included in these calculations as it is a transfer and not included in CBA. However, businesses may be considered to benefit from this reduction.

Some costs are monetised at this stage. Transition costs relating to reading and understanding guidance are difficult to estimate at this stage. Additional costs to the public sector of enforcement are also not monetised at this stage due to insufficient information, but further details will be sought at consultation.

[8] Landfill gate fees are estimated £20 per tonne and haulage £10 per tonne (source WRAP)